

## Chapter Seven: Overview of Conservation Strategies

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In this section, we highlight and provide an overview of ongoing and proposed strategies to conserve the biodiversity of the Commonwealth and the species in greatest need of conservation. These strategies are organized into:

- Proactive Habitat Protection,
- Collection of Biological Information,
- Conservation Planning,
- Environmental Regulation,
- Habitat Restoration and Management,
- Coordination and Partnerships, and
- Conservation/Environmental Education.

Taken as a whole, these activities provide the overarching framework for the conservation, management and restoration of the species in greatest need of conservation identified in the Comprehensive Wildlife Conservation Strategy. **However, the foremost priority among these strategies is the proactive protection of the habitats of the species in greatest need of conservation.**

### A. Proactive Habitat Protection

For almost every species and habitat in greatest need of conservation in Massachusetts, this Strategy recommends that appropriate areas be protected from development and managed for the long-term conservation of these species and habitats. However, about one-sixth of Massachusetts – about one million acres – is already protected by a conservation entity (state, Federal, municipal, or private non-profit). Further, it is clear that the opportunities to protect suitable habitat and the funding with which to protect land are both dwindling rapidly in this state. **Thus, to protect our species in greatest need of conservation, the challenge is that of making the difficult and wrenching decisions about which lands have the highest priority for acquisition in the very near future.**

The Natural Heritage & Endangered Species Program of the MDFW recently completed the BioMap and Living Waters projects. The BioMap is a statewide map of the areas, called Core Habitats, which if protected will conserve viable populations of rare species and exemplary natural communities for the future. The Living Waters project also produced a statewide map, but the Core Habitats shown on this map are the actual waterbodies supporting rare aquatic species and aquatic natural communities. Areas buffering and draining these aquatic Core Habitats, called Critical Supporting Watersheds, are areas which are appropriate for protection, if undeveloped, or for implementation of Best Management Practices to improve run-off water quality, if already developed.

Together, the BioMap and Living Waters Core Habitats cover about one-quarter of Massachusetts. About 40% of these Core Habitats are already protected, but 60%, or some 710,000 acres, are not protected from development or other destructive actions. It will be almost

impossible for all the conservation groups in Massachusetts, not just MDFW, to protect all of this land, plus those areas of Critical Supporting Watershed that are recommended for protection. In addition, the data used by the BioMap and Living Waters projects are now up to five years old and, in some cases, already out of date. Some areas of BioMap Core Habitat have already been developed and have thus been lost as conservation possibilities. Some species thought to be rare at the time of these projects have proved to be more common than thought and thus do not need the level of conservation attention directed at the truly rare species. As time goes on, our knowledge of the species in greatest need of conservation will change, as will the inventory of land available for protection. There should be an on-going process to analyze and prioritize land in the Commonwealth for conservation purposes. The steps below build on the BioMap and Living Waters project and outline this on-going process.

To make and implement this prioritization for land protection, the following elements are necessary:

1. **Knowledge of what land is protected in the Commonwealth, by whom, and for what purpose.** Massachusetts has a very good state GIS system, MassGIS, which constantly updates their data on protected open space, including ownership and purposes. However, due to understaffing, the MassGIS program is often six months to a year behind in adding new state-owned conservation lands to their database. It has no systematic way to update newly protected lands acquired by municipalities or private non-profits. Both of these issues should be addressed. Since development is one of the greatest threats to wildlife in Massachusetts, more up to date landuse maps are needed. Without an accurate and relatively up-to-date database of what is already protected, we cannot plan for future acquisitions effectively and efficiently.
2. **Knowledge of the biological resources of the state, particularly of the species and habitats in greatest need of conservation.** Our knowledge of the statewide distribution of these species and habitats is uneven. For some species (for example, Federally listed species and fish species in general), there have been recent or on-going statewide surveys of all suitable habitat and, thus, our knowledge of their distribution and abundance in the state is relatively complete. MDFW has a comprehensive database of fish distribution and abundance for the fish species listed as in Greatest Need of Conservation. On the other hand, some state-listed species (for example, some aquatic macroinvertebrates) are just now receiving the kind of survey effort that will clarify their distribution and abundance; thus, we do not yet have sufficient knowledge of even all of the state-listed species. For non-listed species in greatest need of conservation, whether globally rare, game animals, or associated with early successional habitats, our state of knowledge is particularly insufficient. Likewise, for some habitats of concern – coastal plain ponds, bogs – we have recent field surveys, targeted at the best examples as identified by aerial photo-interpretation. For other habitats – large, unfragmented natural landscape mosaics – we are just beginning to realize the need for conservation and, frankly, have a difficult time identifying these habitats on the ground. Marine and estuarine habitats have been under-surveyed in general; however, the Massachusetts Office of Coastal Zone Management has recently begun several initiatives aimed at mapping these habitats. Elsewhere in this Strategy, the details of these survey and

inventory needs are covered; here it needs only be noted that this knowledge is absolutely essential for conservation of our biodiversity.

3. **Knowledge of which species and habitats are already protected.** As a consequence of completing the two elements above, it will be possible to clarify the level of protection afforded each of the species and habitats in greatest need of protection. Again, this analysis should be completed, not just for state-owned lands, but for all property owned and/or managed for conservation purposes across the Commonwealth. This element involves inventory and assessment of the biological resources supported in whole or in part by each parcel of protected land, to answer such questions as: What percentage of the occurrences of a SGNC species or habitat are on protected land? Which SGNC species or habitats are least well protected, currently?
4. **Prioritization of protection efforts.** This element involves making what can only be described as judgment calls. For example, all things being equal, what species should be targeted for immediate protection? It is easy to see that different conservationists might answer differently: protect all the occurrences of the very rare species first; or protect first the most viable populations of those species judged most likely to persist if properly conserved; protect first order streams, or protect wildlife corridors first; or protect large, contiguous landscapes of natural habitats first; or protect first what our human constituency at large wants protected – the glamorous and showy rare species, the beautiful landscapes, and their favorite hunting and fishing spots.

In reality, future conservation efforts will involve numerous organizations and individuals; the MDFW is only one of the partners in the cause. Each organization and each scientist or conservationist will have their own priorities for protection, dictated by organization policies, funding sources, and personal preferences. However, with the BioMap and Living Waters projects, many conservation entities in Massachusetts have proven themselves eager to base their protection efforts on biological data, interpreted by knowledgeable scientists, and disseminated to usable formats.

It is a major goal of this Strategy to develop a consistent and objective prioritization system for habitat protection, aimed at the identified species and habitats in greatest need of conservation, with the input of as broad a spectrum of knowledgeable biologists as is feasible.

5. **Identification of land for protection, based on stated priorities.** Once priorities for land protection are established, these priorities should be applied to the existing knowledge of the biological resources of the state, to identify precise areas for immediate protection efforts. A map of these areas will be developed, with information attached to each recommended area as to the particular conservation targets therein. It can be expected that, as a result of this step in the process, along with the preceding steps, gaps in our knowledge will be identified, which can then be filled in the next cycle of this whole process.
6. **Dissemination of conservation priorities to conservation partners.** Providing GIS or paper maps and supporting information to state, Federal, municipal, and private conservation

groups is the first step in implementing proactive habitat protection. Beyond that, it is likely that a detailed examination of the map of areas to be protected will reveal which organizations are most suited to protect each area, because of proximity to land already protected, or the particular priorities of the organization, or some other such factor. A list of unprotected areas suitable for protection by each active conservation group should be compiled and distributed, wherever possible in whatever venue is appropriate. Meetings between MDFW staff and staff from these other groups are likely to be particularly fruitful. An agency database of contact/mailling information of all identified conservation partners needs to be developed to aid in mass postal and electronic communications. Currently, lists exist in various forms but not in any centrally organized fashion that is easily accessible.

7. **Funding.** Admirably, when informed of their land's conservation value, many landowners choose to donate their property to a conservation group. Many conservationists choose to donate their time and skills to a land trust, for example, to help in the cause of land protection. Not surprisingly, land donations are not financially feasible for many landowners, and most land protection efforts cannot be accomplished by a purely volunteer work force. Funding for land protection in Massachusetts has decreased dramatically in recent years, especially at the state level. The tasks of everyone involved in this Strategy will be to inform others of the importance and immediate need for increased funding from all sources for land acquisition, to use available funding as efficiently as possible to accomplish protection priorities, and to identify and cooperate on funding sources beyond the usual. Re-activating the Massachusetts Teaming With Wildlife Coalition, a group formed for the purpose of providing information about federal legislation that would provide funding for unmet wildlife needs, could be one strategy for advocacy of wildlife funding initiatives on both the state and federal levels.
8. **Updates of these protection priorities.** In five to ten years time, the information on which this Conservation Strategy is based will be out of date. The very successful BioMap project was based on data through 2000; it is clear just five years later that, while most of the areas recommended for protection are still worthwhile, new data necessitate an update. Further, both BioMap and Living Waters were aimed at conserving state-listed rare species, in general, and many of the species included in this Strategy are not addressed specifically in either BioMap or Living Waters. Throughout the implementation of the seven steps above, gaps in data should be identified and addressed, progress towards protection priorities should be compiled, and conservation partners should be cultivated. This will inform the next round of setting priorities for proactive habitat protection.

## **B. Biological Information: Surveys, Monitoring, and Databases**

Currently, MDFW maintains extensive databases tracking the occurrences of many species in Massachusetts. NHESP monitors all federally and state-listed rare animals and plants. The Wildlife Section has specific monitoring projects for wildlife species that are not state-listed but are in greatest need of conservation and for which there may be regulated hunting and/or trapping seasons.

### Fish Community Assessment

The Fisheries Section of the MDFW monitors the distribution and abundance of all fish species statewide. To date the Fisheries Section has sampled more than one thousand sites and more than 140,000 fish since 1998. The goal for future fish community assessment will be to sample 180 to 220 locations each year in the habitats of greatest conservation need. The sampling locations will follow the watershed rotation that has been employed since 1999. Priority will be given to sites that will ensure the adequate establishment of the condition of the fish community in mainstem study reaches to enable the comparison of existing conditions to Target Fish Communities as they are established. Priority will also be given to potential Coldwater Fishery Resource waters to allow biological assessments and set management goals for wild salmonids statewide. Index sites will also be selected and resurveyed to monitor trends in fish populations across the state.

### State-Listed and Other Rare Species

In addition to state-listed species, the Natural Heritage and Endangered Program of DFW tracks other plants and animals for which the conservation status in the state is unclear. However, some of the globally rare species in greatest need of conservation, listed in this Strategy, have not been tracked by any section or program of MDFW, and the current distribution and abundance of a number of state-listed species have not been surveyed systematically in recent years. The Natural Heritage Program will continue to track rare species, as it does now, but given sufficient funding and staffing, there are additional species to be monitored and types of surveys to be conducted, as detailed below.

First, the Natural Heritage Program should add to its rare species database those globally rare animals (G1 through G3, rounded) listed in this Strategy which are not already tracked by the Program. These include, with notes as needed, these species:

Scientific Name	Common Name	Global Rarity Ranking	Notes
<i>Microtus breweri</i>	Beach Vole	G1Q	Taxonomic status unclear; determine status first
<i>Corvomeyenia everetti</i>	Mount Everett Pond Sponge	G3	
<i>Alloperla voinae</i>	A Stonefly	G3	
<i>Hansonoperla appalachia</i>	Hanson's Appalachian Stonefly	G3	
<i>Perlesta nitida</i>	A Stonefly	G3G4	
<i>Physa vernalis</i>	Vernal Physa	G3	
<i>Caenestheriella gynecia</i>	Feminine Clam Shrimp	G1G2	Native or exotic status in MA unclear; determine origin first
<i>Enallagma minusculum</i>	Little Bluet	G3G4	
<i>Hadena ectypa</i>	A Noctuid Moth	G3G4	
<i>Macrochilo bivittata</i>	Two-striped Cord Grass Moth	G3G4	
<i>Pieris virginianensis</i>	West Virginia White	G3	
<i>Schizura apicalis</i>	Plain Schizura	G2G4	
<i>Zale curema</i>	Northeastern Pine Zale	G3G4	

Second, the Natural Heritage Program should review the state status (S1 through S5) of species in greatest need of conservation, which are globally common, not already state-listed as rare, and currently ranked S1 through S3, SU, SNA, or SNR. This review should include an assessment of the species' status in Massachusetts and, possibly, proposal for state listing as protected, should a species prove threatened across the state. These species include:

Scientific Name	Common Name	State Rarity Ranking	Notes
<i>Alosa pseudoharengus</i>	Alewife	SNR	
<i>Alosa sapidissima</i>	American Shad	S3	
<i>Salmo salar</i>	Atlantic Salmon	S1	
<i>Ammodramus caudacutus</i>	Saltmarsh Sharp-tailed Sparrow	S3	
<i>Ammodramus maritimus</i>	Seaside Sparrow	S2	
<i>Arenaria interpres</i>	Ruddy Turnstone	SNA	Does not breed in MA
<i>Calidris alba</i>	Sanderling	SNA	Does not breed in MA
<i>Calidris canutus</i>	Red Knot	S2	Does not breed in MA
<i>Clangula hyemalis</i>	Long-tailed Duck	SNRN	Does not breed in MA
<i>Egretta thula</i>	Snowy Egret	S1	
<i>Empidonax traillii</i>	Willow Flycatcher	S4	
<i>Haematopus palliatus</i>	American Oystercatcher	S2	
<i>Histrionicus histrionicus</i>	Harlequin Duck	SNRN	Does not breed in MA
<i>Larus atricilla</i>	Laughing Gull	S2	
<i>Limnodromus griseus</i>	Short-billed Dowitcher	SNA	Does not breed in MA
<i>Numenius phaeopus</i>	Whimbrel	SNA	Does not breed in MA
<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	S2	
<i>Porzana carolina</i>	Sora	S3	
<i>Somateria mollissima</i>	Common Eider	S1	
<i>Vermivora pinus</i>	Blue-winged Warbler	S3	
<i>Alces alces</i>	Moose	S1	
<i>Lasionycteris noctivagans</i>	Silver-haired Bat	SU	
<i>Lasiurus cinereus</i>	Hoary Bat	SU	

Finally, specific taxa need systematic surveys and research efforts statewide, as noted in the following table. Although many of the species covered in this Strategy were covered here, not every taxon needs survey and research effort. For example, the distribution of freshwater mussels in Massachusetts has been extensively surveyed in the past five years. While there are a few gaps still to be filled, in general, these taxa do not need systematic statewide surveys.

Taxonomic Group	Scientific Name	Common Name	Notes
Amphibians	<i>Gyrinophilus porphyriticus</i>	Spring Salamander	May be more common and secure than currently documented; difficult to observe.
	<i>Hemidactylium scutatum</i>	Four-Toed Salamander	May be more common and secure than currently documented; difficult to observe.
	<i>Rana pipiens</i>	Northern Leopard Frog	Of regional conservation concern; status in MA is unclear.

<b>Taxonomic Group</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Notes</b>
Reptiles	<i>Caretta caretta</i> <i>Chelonia mydas</i> <i>Eretmochelys imbricata</i> <i>Lepidochelys kempii</i> <i>Dermochelys coriacea</i>	Seaturtles	Current tracking efforts are inadequate; NHESP should track rescued seaturtles, salvaged specimens (including cause of death), distribution, abundance, age structure, and movements in MA waters.
	<i>Clemmys guttata</i> <i>Clemmys insculpta</i> <i>Clemmys muhlenbergii</i> <i>Terrapene carolina</i>	Spotted Turtle Wood Turtle Bog Turtle Eastern Box Turtle	NHESP has more than 200 documented occurrences of each of these turtles; the need is to determine if the longterm viability of these long-lived species is threatened in MA. Research needs include long-term trend monitoring, size and age structure of existing populations, percentage of populations that are currently protected, efficacy of remediation attempts related to environmental review projects.
	<i>Emydoidea blandingii</i>	Blanding's Turtle	This species is highly threatened by sprawling development; research needs include full extent of distribution, acreage necessary for viable populations, efficacy of remediation attempts (tunnels, drift fences, created nest sites, etc.), age structure of existing populations, long-term (5-10 years) monitoring of populations, and coordination with New Hampshire researchers, at least.
	<i>Malaclemys terrapin</i>	Diamondback Terrapin	Possible breeding habitat should be surveyed systematically for presence/absence of terrapins.
	<i>Pseudemys rubriventris</i> pop. 1	Northern Red-Bellied Cooter	Ponds where head-started hatchlings were released should be surveyed every five years, to determine success of head-starting. Also needed are short-term intensive surveys to determine nest success, etc.
	<i>Elaphe obsoleta</i> <i>Agkistrodon contortrix</i> <i>Crotalus horridus</i>	Eastern Ratsnake Copperhead Timber Rattlesnake	Not all den sites of these snakes are documented; long-term monitoring of den sites is needed. Movement distances and habitat use in MA should be investigated.
	<i>Heterodon platirhinos</i>	Eastern Hognose Snake	Of regional conservation concern; status in MA is unclear.
	<i>Thamnophis sauritus</i>	Eastern Ribbon Snake	Of regional conservation concern; status in MA is unclear.

<b>Taxonomic Group</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Notes</b>
Birds	<i>Podilymbus podiceps</i> <i>Botaurus lentiginosus</i> <i>Ixobrychus exilis</i> <i>Rallus elegans</i> <i>Gallinula chloropus</i> <i>Cistothorus platensis</i> <i>Ammodramus henslowii</i>	Pied-Billed Grebe American Bittern Least Bittern King Rail Common Moorhen Sedge Wren Henslow's Sparrow	Marsh Birds – difficult to observe, these birds should be surveyed every five years, using callback techniques and standardized methods.
	<i>Asio otus</i>	Long-eared Owl	Current nesting status in MA should be checked
	<i>Caprimulgus vociferus</i> <i>Histrionicus histrionicus</i> <i>Seiurus motacilla</i> <i>Wilsonia canadensis</i>	Whip-poor-will Harlequin Duck Louisiana Waterthrush Canada Warbler	Of regional conservation concern; status in MA is unclear.
	<i>Clangula hyemalis</i> <i>Somateria mollissima</i>	Long-tailed Duck Common Eider	MA waters host very large wintering concentrations of these species; survey yearly for abundance, location, and movements
Mammals	<i>Sorex palustris</i> <i>Sorex dispar</i> <i>Synaptomys cooperi</i>	Water Shrew Rock Shrew Southern Bog Lemming	Full extent of distribution and abundance of these small mammals in MA is not well known.
	<i>Physeter catodon</i> <i>Balaenoptera physalus</i> <i>Balaenoptera borealis</i> <i>Balaenoptera musculus</i> <i>Megaptera novaeangliae</i> <i>Eubalaena glacialis</i>	Sperm Whale Fin Whale Sei Whale Blue Whale Humpback Whale Northern Right Whale	Current tracking efforts are inadequate; NHESP should track rescued efforts, salvaged specimens (including cause of death), distribution, abundance, age structure, and movements in MA waters.
	<i>Lasionycteris noctivagans</i> <i>Lasiurus borealis</i> <i>Lasiurus cinereus</i>	Silver-haired Bat Eastern Red Bat Hoary Bat	Of regional conservation concern; status of these species in MA is unclear.
	<i>Phocoena phocoena</i>	Harbor Porpoise	Of regional conservation concern; status in MA is unclear.
	<i>Sylvilagus transitionalis</i>	New England Cottontail	Possible candidate for federal listing; NHESP should compile all available current and historic data on distribution and abundance in MA, and should institute systematic surveys in likely habitat.
	<i>Spongilla aspinosa</i> <i>Polycelis remota</i> <i>Macrobdella sestertia</i>	Smooth Branched Sponge Sunderland Spring Planarian New England Medicinal Leech	These species have not been inventoried in recent years; full extent of distribution is likely unknown.



<b>Taxonomic Group</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Notes</b>
Crustaceans	<i>Eubbranchipus intricatus</i> <i>Eulimnadia agassizii</i> <i>Limnadia lenticularis</i>	Intricate Fairy Shrimp Agassiz's Clam Shrimp American Clam Shrimp	Vernal Pool invertebrates - full extent of distribution is likely unknown.
	<i>Gammarus pseudolimnaeus</i> <i>Stygobromus borealis</i> <i>Stygobromus tenuis tenuis</i>	Northern Spring Amphipod Taconic Cave Amphipod Piedmont Groundwater Amphipod	Spring and Cave invertebrates - full extent of distribution is likely unknown.
	<i>Synurella chamberlaini</i>	Coastal Swamp Amphipod	Full extent of distribution is likely unknown.
Dragonflies and Damselflies	<i>Boyeria grafiana</i> <i>Gomphus abbreviatus</i> <i>Gomphus desertus</i> <i>Gomphus fraternus</i> <i>Gomphus quadricolor</i> <i>Gomphus vastus</i> <i>Gomphus ventricosus</i> <i>Neurocordulia obsoleta</i> <i>Neurocordulia yamaskanensis</i> <i>Ophiogomphus aspersus</i> <i>Ophiogomphus carolus</i> <i>Stylurus amnicola</i> <i>Stylurus scudderi</i> <i>Stylurus spiniceps</i>	Ocellated Darner Spine-Crowned Clubtail Harpoon Clubtail Midland Clubtail Rapids Clubtail Cobra Clubtail Skillet Clubtail Umber Shadowdragon  Stygian Shadowdragon  Brook Snaketail  Riffle Snaketail  Riverine Clubtail Zebra Clubtail Arrow Clubtail	Riverine odonates; need systematic surveys of all watersheds statewide.
	<i>Somatochlora elongata</i> <i>Somatochlora forcipata</i> <i>Somatochlora georgiana</i> <i>Somatochlora incurvata</i> <i>Somatochlora kennedyi</i> <i>Somatochlora linearis</i>	Ski-Tailed Emerald Forcipate Emerald Coppery Emerald Incurvate Emerald Kennedy's Emerald Mocha Emerald	Emeralds – breeding sites in MA are virtually unknown.
	<i>Enallagma carunculatum</i>	Tule Bluet	May be more common than is documented.
Beetles	<i>Cicindela duodecimguttata</i> <i>Cicindela dorsalis dorsalis</i> <i>Cicindela limbalis</i> <i>Cicindela patruela</i> <i>Cicindela purpurea</i>	Twelve-Spotted Tiger Beetle Northeastern Beach Tiger Beetle Bank Tiger Beetle Barrens Tiger Beetle Purple Tiger Beetle	Full extent of distribution of these species is likely unknown.

<b>Taxonomic Group</b>	<b>Scientific Name</b>	<b>Common Name</b>	<b>Notes</b>
Butterflies and Moths	<i>Apamea inebriata</i>	Drunk Apamea Moth	Butterflies and moths of marshes and other wetlands; distribution across the state is not well documented.
	<i>Apamea mixta</i>	Coastal Plain Apamea Moth	
	<i>Bagisara rectifascia</i>	Straight Lined Mallow Moth	
	<i>Euphyes dion</i>	Dion Skipper	
	<i>Neoligia semicana</i>	Northern Brocade Moth	
	<i>Papaipema</i>	Pitcher Plant Borer	
	<i>appassionata</i>		
	<i>Papaipema sp. 2</i>	Ostrich Fern Borer	
	<i>Papaipema stenocelis</i>	Chain Fern Borer	
	<i>Spartiniphaga inops</i>	Spartina Borer	

To complement these survey and research efforts, the Natural Heritage Program needs more extensive data on the statewide distribution of the habitats important to these species in greatest need of conservation. For some habitats or natural community types – coastal plain ponds, floodplain forests, bogs – the Program has already identified likely examples through aerial photo-interpretation and has conducted ground surveys of many of the best examples of each habitat or natural community. Since the habitat groupings for the CWCS are new, a new statewide effort to identify and inventory the best examples of these important areas needs to be undertaken, either through aerial photo-interpretation or on the ground. For effective and efficient gathering of biological information, as well as for any conservation efforts, identifying occurrences of these habitats is a necessity.

## C. Conservation Planning for CWCS Habitats and Species

### Species Habitat Mapping Project

In all of the habitat types discussed in this Comprehensive Wildlife Conservation Strategy, one of the proposed Conservation Actions is the delineation of Species Habitat Polygons for each current, documented record of a state-listed rare animal.

The primary objective of this project is to identify the spatial habitat “footprint” of each of Massachusetts’ state-listed wildlife species based on documented point observations. Inferring, delineating, and digitally recording the specific habitat areas in Massachusetts for rare wildlife on a species-by-species basis will allow these modular “species habitat” polygons to be used in a variety of projects. Such uses include biological research and inventory, conservation planning, as well as the development of adaptable, scientifically rigorous habitat mapping for use in regulation. Other important steps of this job are to:

- 1) review, update, and document the spatial habitat requirements of *each* of the state-listed wildlife species;
- 2) evaluate the habitat quality associated with *each* rare species *observation*; and
- 3) delineate regulatory areas for each species’ habitat to create a statewide regulatory map, showing the areas within which proposed alterations will trigger NHESP regulatory review under the Massachusetts Endangered Species Act and the Massachusetts Wetlands Protection Act regulations .

In Massachusetts, there are over 185 state-listed wildlife species, including several rare mammals, birds, reptiles, amphibians, fishes, dragonflies and damselflies, moths and butterflies, beetles, freshwater mussels, and snails. For all of Massachusetts's rare animal species, Natural Heritage biologists will develop biologically sound mapping guidelines for extrapolating species habitats from documented records. This task will require consultation with other expert biologists, as well as review of the scientific literature on habitat requirements, species movement distances, and life history strategies. Once developed, these species-specific habitat mapping guidelines will be documented in the Natural Heritage database for future reference, for use in updating species habitat polygons for revised rare species records and in creating species habitat polygons for new rare species records.

Because of the size and complexity of this task, as well as the current lack of site-specific knowledge of CWCS species that are not state-listed, species of greatest conservation concern that are not on the current MESA list will not have Species Habitat Polygons delineated for them.

The mapping guidelines for each species will then be applied to the thousands of current observations of state-listed wildlife in Massachusetts in the Natural Heritage & Endangered Species Program's database. For each rare species observation, biologists will digitize in GIS the boundaries of appropriate habitat using the established mapping guidelines, as well as information contained within the documented observation record, color aerial photographs, and a suite of standardized GIS data layers, such as topography, hydrography, land cover and land use. Information about each mapped species habitat polygon will be stored in the Natural Heritage database for future reference and updating.

While delineating the extent of each species' habitat, Natural Heritage biologists will simultaneously assign A-to-D ranks for the rare wildlife occurrence based on the landscape context, the population size (if known), and the population condition (if known). This ranking will add to the utility of the Species Habitat Polygons for conservation planning or use in regulations by providing a rough measure of the quality of the species habitat.

Parallel to the creation of Species Habitat Polygons, Natural Heritage biologists will develop and document species-based recommendations for creating regulatory maps from the delineated Species Habitat Polygons. For example, to create regulatory maps from Species Habitat Polygons for certain rare aquatic species, a small watershed-based buffer distance from the water's edge may be added, whereas Species Habitat Polygons for grassland animals might be buffered by a set-distance linear buffer to create their regulatory map. Natural Heritage biologists and GIS staff will digitize these regulatory areas, linked to the Species Habitat Polygons and the original observations. Then, GIS staff will amalgamate regulatory areas for individual species to create and publish Natural Heritage's final statewide regulatory maps for use under the Massachusetts Endangered Species Act and the Massachusetts Wetlands Protection Act regulations. Using this modular, bottom-up approach to creating regulatory maps for rare species will provide a scientifically rigorous and flexible regulatory coverage, which can be updated easily with any future changes in the underlying species occurrence data.

NHESP biologists will also evaluate the Species Habitat Polygons to determine land protection needs. The following questions, and possibly others, will be answered:

- What percentage of the occurrences of each rare species is protected?
- What are the “best” unprotected occurrences of each rare species, which should be targeted for protection?
- Has the number of protected occurrences and populations of a species reached the threshold needed to consider down-listing or de-listing that species?
- Where can scarce land protection funds be expended to conserve rare species most effectively and efficiently?

The answers to these questions will inform the land protection activities of the Division of Fisheries & Wildlife, as well as other conservation groups – statewide nonprofits, municipal conservation commissions, local and regional land trusts – seeking to conserve biodiversity in Massachusetts.

Thus, the creation of these Species Habitat Polygons will prove useful in proactive habitat protection, in environmental regulation, and in conservation planning, as discussed elsewhere in this section. Without this systematic analysis of the likely actual habitat used by each rare species in the state, the thorough, consistent, and complete conservation of Massachusetts’ species of conservation concern will inevitably falter.

### **Wildlife Habitat Mapping**

The Wildlife Section has been collecting animal behavior and movements, habitat use, survival and mortality, and harvest information for many of the species in greatest need of conservation. Much of these data will be useful in developing species habitat, landscape, and regional conservation strategies using GIS mapping and analysis. The Wildlife Section intends to increasingly use these tools in the future.

### **Fisheries Habitat Mapping Project**

A series of maps will be prepared for each aquatic habitat that identifies the current distribution of fish in greatest need of conservation, identifies potential conservation and restoration actions, and highlights restoration goals. These maps will not only include biological information, but land-use characteristics that relate to fish and wildlife habitat integrity.

### **Fisheries Habitat Initiative**

The Fish Habitat Initiative analytically assesses aquatic resources in the Commonwealth, identifies those resources that are in the most need of restoration and conservation, and ultimately protects the biological integrity of fish and wildlife habitat at the watershed level. Fish and fish communities serve as excellent indicators of environmental condition for several reasons. Fish are sensitive to a wide array of stresses, integrate the impacts of those stresses in their attempts to survive, reproduce, and grow, and are relatively long lived (Faush et al. 1990). The MDFW will use fish community assessments to identify the current status of fish and wildlife resources, implement Target Fish Community (TFC) analyses to set measurable goals for restoration, and rely on habitat mapping and Indexes of Biotic Integrity (IBIs) to set the most efficient course for accomplishing those goals.

## Species Conservation Plans

For a number of the rare animals discussed in this Strategy, it is difficult to judge the conservation status of these species in the state. Populations of animals which inhabit discrete, relatively small habitat types – grassland birds, bog-dwelling dragonflies, or cave amphipods, for example – may reasonably be said to be conserved in Massachusetts when all or most of the habitats known to harbor these species have been protected and are being managed appropriately. On the other hand, animal populations which use a variety of habitat types, traverse large areas, or need Large Unfragmented Landscape Mosaics, such as Blanding's and Spotted Turtles, Bald Eagles, or the Chain Dot Geometer moth, are less easy to assess in terms of conservation status.

For this latter group of species, NHESP proposes to create conservation plans for each species or suite of species. These plans will summarize for each species the taxonomy, species biology, habitat, ecology, threats, distribution and status (globally and within Massachusetts), and current conservation efforts. Occurrences in Massachusetts will be discussed in detail and any gaps in essential knowledge will be identified. Measurable thresholds for each step in a potential down-listing or de-listing process will be proposed. These thresholds may include such criteria as number of protected populations, rate of survival to breeding age, necessary management actions, and distribution of populations across historic range, among many other possible items. Draft conservation plans will be circulated for comments to outside experts and will be approved by the Natural Heritage & Endangered Species Advisory Committee and the Fisheries & Wildlife Board.

Once a conservation plan for a species is drafted and approved, MDFW will devote resources as available to conducting any needed research and inventory, protecting documented occurrences, managing occurrences appropriately, and completing any other actions necessary to meet the threshold for down-listing or de-listing the species in question.

The first set of conservation plans to be drafted will include a number of species chosen for the reasons given below:

- Spotted, Eastern Box, Wood, and Blanding's Turtles: Terrestrial or semi-terrestrial turtles such as these have proved particularly susceptible in Massachusetts to crushing by on-road and off-road vehicles, fragmentation of habitat, increases in nest predators such as raccoons and skunks, removal as pets, and destruction of habitat for development. Numbers of documented current records for these species range from fewer than 200 (Blanding's Turtle) to more than 700 (Spotted Turtle), yet it is unknown how many viable populations there are in the state and how many of those are currently protected adequately. Complicating this assessment is the turtle life history strategy of very high egg and juvenile mortality coupled with the very long lives of reproductive adults, which results in populations declining even if there are very low adult mortality rates.
- Pitch Pine/Scrub Oak invertebrates: Twenty-seven Lepidoptera and two Coleoptera of conservation concern are associated with Pitch Pine/Scrub Oak communities in Massachusetts. Pitch Pine/Scrub Oak is a dynamic community, fluctuating both temporally and spatially in natural situations. However, suppression of fire and strong development pressures have resulted in both reduced acreage of Pitch Pine/Scrub Oak statewide and in reduced heterogeneity of habitat patches within Pitch Pine/Scrub Oak. These reductions, in turn, have affected Pitch Pine/Scrub Oak invertebrates strongly, as many of them are adapted

to particular seral stages within the Pitch Pine/Scrub Oak community, and need very large areas of patchy habitat to survive as meta-populations.

- **Undersurveyed Aquatic Macroinvertebrates:** A number of the aquatic macroinvertebrates of conservation concern have received very little systematic survey effort in Massachusetts. The conservation status of these animals is unclear simply because of this lack of data. Conservation plans for these species will be drafted, emphasizing and outlining the survey needs. Once these initial surveys are completed, assessment of the conservation status of these species will be more accurate. Species of conservation concern to be covered in this first stage of conservation planning include: snails, amphipods, clam shrimp, fairy shrimp, riverine odonates, some tiger beetles, wetland Lepidoptera, and miscellaneous invertebrates.

## D. Environmental Regulation

A major function of the Natural Heritage and Endangered Species Program is to review the likely impact of proposed development projects or wetland alterations on rare species and their habitats. The Program reviews about 1,850 projects a year and plays a critical role in implementing two of the state's environmental laws. Landowners, developers, land use planners, transportation planners, and government officials, among others, are always welcome to consult with the NHESP in the early stages of a proposed project, to discern the possible impacts to rare species habitat and to identify any filings required under state laws.

### ***Massachusetts Endangered Species Act*** (M.G.L. c.131A and regulations 321 CMR 10.00)

The Massachusetts Endangered Species Act (MESA) prohibits the "taking" of any rare plant or animal species listed as Endangered, Threatened, or of Special Concern by the MA Division of Fisheries & Wildlife. "Taking" is defined under the act as to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding or migratory activity of an animal or to collect, pick, kill, transplant, cut or process a plant. Permits for taking rare species for scientific, educational, conservation, or management purposes can be granted through the Division of Fisheries & Wildlife.

The NHESP has developed **Priority Habitat** maps to inform the public about rare plant and animal species locations. The maps can be viewed in the Natural Heritage Atlas, which is published about every two years, or at the MassGIS data layers.

The regulations implementing the Massachusetts Endangered Species Act have recently undergone significant revisions in order to clarify project review filing requirements, provide clear review timelines, and establish an appeal process for agency actions. These regulatory changes, which took effect on July 1, 2005, are linked to the establishment of filing fees to support MESA implementation. The MESA changes reflect an approximately 2-year process of agency consideration, with ample opportunity for input from key stakeholders and the public. We are confident that these regulatory changes achieve the goal of providing a clearer, more user-friendly process for project proponents without weakening protection for state-listed rare species and their habitats.

### ***Massachusetts Wetlands Protection Act*** (M.G.L. c.131, s.40 and regulations 310 CMR 10.00)

The Wetlands Protection Act Regulations require that proposed alterations to the wetland habitats of rare wildlife be reviewed by the Natural Heritage & Endangered Species Program.

Alterations that would have short or long term adverse effects to the wetland habitats of rare wildlife species are prohibited.

The Natural Heritage & Endangered Species Program has developed town maps for the state that show **Estimated Habitats** of Rare Wildlife. These maps show estimated habitats for documented occurrences of rare wetlands wildlife within the last 25 years and are updated periodically. Local conservation commissions have copies of these maps and these maps are also published in the Natural Heritage Atlas. Proponents of wetland alteration projects must submit Notice of Intent forms to local conservation commissions. Proponents are responsible for checking the Estimated Habitat of Rare Wildlife maps and, if the project falls in a delineated Estimated Habitat, also submitting a copy of the Notice of Intent directly to the Natural Heritage & Endangered Species Program.

NHESP will determine whether the area to be altered by a proposed project is actual wetland habitat for a state-listed rare wildlife species. The NHESP will then determine whether the proposed project will have an adverse effect and communicate this opinion to the local conservation commission. The local conservation commission shall presume this opinion to be correct. The conservation commission cannot issue an Order of Conditions, allowing the project to proceed, for at least 30 days after the filing of the Notice of Intent or until NHESP has communicated its opinion to the commission.

A major function of the Fisheries Program is to review the possible impacts of proposed development projects or wetlands alterations on state-listed fish species and their habitats. The program reviews about 200 projects each year and plays a critical support role in providing technical assistance to other state and federal environmental regulatory agencies.

**Massachusetts Forest Cutting Practices Regulations** (304 CMR 11.00) require reviews of forest cutting plans and potential impacts on rare species. The Natural Heritage & Endangered Species Program has developed maps of Priority Habitats of Rare Species. These maps are published by the NHESP in the same atlas as the Estimated Habitats of Rare Wildlife maps. All forest cutting plans being reviewed by the MA Department of Conservation and Recreation (DCR) foresters that also fall in areas of Priority Habitat or Estimated Habitat will be sent to the NHESP for a determination of whether the proposed activity will adversely impact rare species. DCR foresters have a copy of the most recent NHESP atlas.

The **Massachusetts Environmental Policy Act** (MEPA) (M.G.L. c.30, secs. 61-62H) also provides for the review of potential impacts to rare species populations by proposed development projects. For MEPA review, all projects occurring on a site of two or more acres within Priority Habitats delineated by the NHESP are required to file with the NHESP for review of rare species impacts. All projects that require the filing of an Environmental Notification Form will be reviewed by NHESP.

### **Certification of Vernal Pools**

The Natural Heritage & Endangered Species Program "certifies" the occurrence of vernal pools based on documentation of the pool's use by one or more groups of species that rely on vernal pools. This process relies on volunteers to identify vernal pools, and to collect and submit

documentation. The Natural Heritage and Endangered Species Program's "Guidelines for the Certification of Vernal Pool Habitat" describe the requirements for the documentation of biota using a vernal pool, and also has information on the maps that are required in order to obtain certification for a vernal pool. They also have general information regarding the physical characteristics of vernal pools, and some techniques for finding them. Once NHESP certifies a pool, notice of this certification is sent to the local Conservation Commission, the regional office of the DEP, the landowner (if the owner's address is known), and the person filing the certification forms. Landowner permission is not required for certification, but as it states on the certification form, "It is strongly recommended that landowner permission be obtained prior to collecting certification documentation." See <http://www.mass.gov/dfwele/dfw/nhesp/nhcvp.htm> for more information on certifying vernal pools.

The Heritage Program has certified about 2000 vernal pools to date. Official certification provides a vernal pool, and up to 100 feet beyond its boundary in some cases, certain protections under several state and federal laws. Originally defined and protected under the Massachusetts Wetlands Protection Act regulations, Certified Vernal Pools now also receive protection under Title 5 of the Massachusetts Environmental Code, Section 401 of the Federal Clean Water Act, the Massachusetts Surface Water Quality Standards which relate to Section 401, and the Massachusetts Forest Cutting Practices Act. These regulations help to eliminate direct impacts to certified vernal pools and to minimize indirect impacts. The Department of Environmental Protection (DEP) is responsible for the implementation of these regulations (except for the Forest Cutting Practices Act, administered by the Department of Conservation and Recreation), and has designated specific staff as vernal pool liaisons.

## **E. Habitat Restoration and Management**

Habitat: The area or type of environment in which a plant or animal normally occurs.  
Restoration: The process of returning ecosystems or habitats to their original structure, dynamism, variability and species composition.  
Management: The act of determining past, current, and desired future condition of land and water, and facilitating actions to achieve desired conditions.

Habitat restoration and management involves both the manipulation and protection of existing conservation land, as well as the acquisition of additional lands that influence habitats of concern. This section will focus on the manipulation and protection of existing lands.

### **Restoration**

#### **Migratory Fish Restoration Project**

This project is centered on the two large rivers within the Commonwealth, the Connecticut and Merrimack Rivers. The goals of this program include providing access to historic spawning areas within these watersheds for several species of migratory fish listed as species in greatest need of conservation, such as American shad, blueback herring and American eel. The effort to restore Atlantic salmon is covered in more detail in the Partnership section of this chapter. Over the past several years MDFW has worked with the USGS Silvio Conte Anadromous Fish



Research Center and taken great steps to provide novel fish passage structures for American eels at several hydroelectric dams in the state in a proactive effort to rebuild these populations.

#### River Continuity Program

MDFW biologists work with the State's River Continuity Program to provide them with technical assistance to help guide their efforts. This program seeks to identify mostly small barriers to fish passage, such as culverts, which result in fragmented rivers throughout the Commonwealth. Alternatives are then constructed which will allow fish passage for all resident and migratory species present. Bronson Brook in Worthington, Massachusetts, is an example of one such project. Here, an existing culvert will be replaced and another retrofitted to allow fish passage, thus opening up three miles of stream habitat to several species in greatest need of conservation, including brook trout and Atlantic salmon. Partners in this project include the Natural Resource Conservation Service, Riverways Program, MDFW, and the Town of Worthington.

#### Eastern Brook Trout Joint Venture

This program seeks to conserve Brook Trout throughout its range in the Eastern United States. MDFW participates in the Eastern Brook Trout Joint Venture in several important ways, including: attending national organizational and planning meetings, serving on the Data Collection and Conservation Strategies Work Groups, and allowing use of the extensive MDFW database on distribution and abundance of Eastern brook trout in all subwatersheds statewide.

#### Hydropower licensing

MDFW plays a key technical role in aquatic habitat restoration through the licensing and relicensing of hydroelectric dams throughout the state. MDFW involvement, along with partners including watershed associations, Trout Unlimited, and the U.S. Fish and Wildlife Service, has led to establishing instream flow requirements to previously dry or otherwise flow-affected river reaches. These efforts have restored several miles of riverine habitat on the Chicopee, Westfield and Deerfield Rivers. In addition, requirements for operations at the hydroelectric plants which reduce "peaking" power production have lessened the fluctuations in headpond elevations, protecting species in greatest need of conservation, such as the Puritan Tiger Beetle, which live or breed on the shoreline of these impoundments. Other critical results of hydropower licensing include reducing habitat fragmentation caused by dams and providing upriver and downriver fish passage for anadromous/catadromous species and resident fish species.

#### Ecological Restoration Project

The Ecological Restoration Project (ERP) uses the NHESP database and field surveys to identify important sites that support rare wildlife species where habitats are in need of restoration or rehabilitation. Four factors have emerged as primary causes of habitat degradation for wildlife in Massachusetts: fire exclusion, invasive non-native plants, hydrological alterations, and off-road vehicle damages. The ecological restoration staff, often in collaboration with academic and conservation organization scientists, develops plans for reversing habitat degradation and implements appropriate restoration actions.

Fire exclusion: Numerous descriptions of colonial Eastern North America mention the extensive use of fire by Native peoples (Stewart 2002, Pyne 1982). Native peoples used fire to attract wildlife and enhance wildlife habitat in addition to a multitude of other applications. The widespread and frequent use of fire by native peoples or immigrants was immediately challenged and curtailed by European settlers and fires have increased in frequency but decreased in area affected since the 1700s (Pyne 1982). The conditions created by periodic fire represent habitat for dozens of species of conservation concern in Massachusetts. In fact, of the approximately 115 terrestrial species targeted by this plan, 64 (55%) benefit from conditions created by fire. The range of wildlife species that would benefit from increased fire management includes game species such as black bear and many terrestrial vertebrates (Wright and Bailey 1982), federally protected species such as Bog Turtle, and most of the terrestrial invertebrates targeted in this plan. Of the 22 macrohabitat types described in this plan, at least nine (37%) are influenced by periodic fire. The beneficial conditions created by periodic fire include the maintenance and restoration of primary breeding, feeding and foraging habitat. Pitch pine/scrub oak barrens, young forests, grasslands, and rock cliffs are among the habitats that may be enhanced by periodic fire.

Reversing degradation caused by fire exclusion will require that many more acres of various habitat types receive prescribed fire treatments over the next decade. While Massachusetts has a skilled multi-agency prescribed fire crew that has been operating successfully for almost 20 years, it lacks the capacity to manage all the sites requiring fire management. All the ecoregions in the state have sites and habitats where prescribed fire should play a role in restoration and management of target species and habitats. However, most fire management in the state is confined to southeastern Massachusetts and one site in the Connecticut Valley. Each site that has been selected for prescribed fire management requires a prescribed burning plan, implementation by a trained crew, monitoring ecological results of fires, and acquiring permits from local authorities and the Department of Environmental Protection's Air Quality Section. Many sites require pre-treatment of hazardous fuels in order to apply prescribed fire successfully and safely.

Numerous sites in the state have vegetation that is highly prone to frequent fires. Such fires may present a threat to public health and safety from wildfire and smoke, as opposed to fires burning under controlled conditions when smoke dispersal is addressed. Fire, at appropriate time and scale, can induce habitat heterogeneity vital to populations of at-risk species. Too much fire at a time can have negative consequences resulting in mortality to individual target species and habitat homogeneity (Whelan 1995).

In order to expand a statewide fire program and prioritize sites for fire management, ERP will collaborate with federal, state and private partners to develop a fire regime condition classification for all fire-influenced priority habitats and species in the state. ERP will draft and revise fire management plans for selected sites and work with partners in developing standardized fire management policies, practices and monitoring protocols. ERP will collaborate with state and federal agencies to implement fire at appropriate scales to improve and restore heterogeneity. Finally, ERP will develop materials to educate the public about the importance of prescribed fire as a wildlife habitat management tool.

Invasive plants in rare species habitats: The Ecological Restoration Program focuses most of its efforts and resources on state and federally listed species. Many sites important to the conservation of these species require invasive plant control or defense. Early detection and control are vital to preventing habitat loss to invasive plants. Each site requiring invasive plant control requires a plan, often requiring permits from local and state agencies, implementation by state-certified pesticide applicators, and monitoring to detect changes caused by treatments.

Currently, the Ecological Restoration Program has one licensed applicator for small projects and contracts with specialists on larger scale projects. To successfully protect and defend all the sites where control is necessary will require much greater capacity than is currently available. ERP will use the NHESP database and consult with knowledgeable partners in developing and implementing an invasive species strategic plan for at-risk species habitat restoration. These partners already include the Massachusetts Aquatic Invasive Species Working Group, the Massachusetts Invasive Plant Advisory Group, and the Office of Coastal Zone Management.

Impacts from Hydrological Alteration: Agents of hydrological alterations that degrade aquatic and wetland priority habitats targeted by this plan include impoundments by dams and causeways, stream channelization, road run-off, excessive groundwater extraction, the spread of invasive aquatic plants, bank stabilization, erosion control devices, nutrient enrichment and pollution. Of the 22 habitats targeted by this plan, 17 (71%) are subject to degradation by hydrological alteration. The ERP has worked with partner agencies on the assessment of groundwater extraction impacts to coastal plain ponds and Atlantic white cedar swamps in very local areas. However, the threat is widespread and no strategies or standardized methods of assessing and mitigating impacts exist. Currently, the most at-risk habitat type threatened by groundwater extraction is the Coastal Plain Pond, where rapid population growth in southeastern Massachusetts is creating a greater demand for water than can be sustained by the water budgets for the ponds.

ERP will work with federal, state and non-profit agencies to assess the most threatened sites and species and develop water management policies and strategies to prevent or reverse degradation from excessive groundwater extraction.

Off-road vehicle damage: Illegal operation of off-road vehicles (ORVs) is resulting in catastrophic and widespread damage to the natural areas and their dependent wildlife species in Massachusetts. All but open water habitats are currently being damaged directly by ORVs and others are impacted indirectly. ORVs alter drainage patterns, destroy habitat, and introduce invasive plants and animals, in addition to causing the mortality of individual animals. While state law exists to protect habitats from ORVs, there is very little capacity for education and enforcement. The public is generally unaware of the magnitude of the damage inflicted to wildlife by ORVs. Many ecological restoration projects are not feasible because habitats are too heavily used by ORVs.

There have been some success stories in reversing degradation by ORVs, particularly in nesting areas for coastal birds. Currently, a few selected sites are targeted for education of ORV riders and providing a presence on some of DFW's more remote and abused sites, but the need is much greater than current capacity. ERP will work with state, and local agencies and non-profits and

ORV enthusiasts to develop education and enforcement strategies to restore habitats for at-risk species across the state.

## **Management**

In most cases, management involves manipulating or changing existing features because the desired future condition is typically different than the present condition. However, if the present and desired conditions are the same, management involves maintaining rather than changing existing features. In general, management of wetland resources will involve maintaining current conditions. This is often accomplished by limiting activities within the wetland resource (e.g., no draining, road building, etc), and by establishing buffer zones immediately outside the resource area where management is mitigated (e.g., limiting timber harvest to 50% of basal area within 50 or 100' of a wetland), and development is restricted (e.g., no construction within 100 or 200' of a wetland).

Management of upland resources typically involves reclamation and maintenance of grasslands and shrublands, and establishment of successional stages of forestlands (see Chapter 9, Conservation Strategies by Habitat). The MDFW's Upland Habitat Program and Forestry Program both focus on active habitat management.

The Upland Habitat Management Program (Upland Program) was developed to address long-term population declines in native wildlife species associated with early-successional habitats. The Upland Program reclaims and maintains early-successional habitats that have declined throughout the state over the past several decades, primarily through management of post-agricultural or abandoned field habitats.

Abandoned field reclamation involves removing invading woody vegetation and controlling invasive exotic plants to re-establish early-successional habitat (i.e. native herb/shrub or grassland communities). The priority of an individual property for management is determined by its landscape setting. High priority sites are relatively large (generally >2 ha), and/or occur adjacent to or near (<400 m) other open habitats. The Upland Program seeks to cluster large areas of early-successional habitat to minimize the potential deleterious impacts associated with fragmented habitats including increased nest predation rates, increased risk of population extinctions, and increased potential for invasion by exotic species.

Landclearing machinery is often used to cut and mulch invading woody vegetation. Landclearing machinery includes industrial flail mowers (hydro-axe or an excavator-mounted rotary drum mower/mulcher) on sites that have been abandoned (unmanaged) for 10-15 years. For trees that are beyond the size capacity of flail mowers, tree shears, skidders, and chippers are used, typically on sites 15-30 years post-abandonment. Most, but not all, woody vegetation is removed; valuable food-producing trees and shrubs such as wild apple, dogwood, viburnum, blueberry and serviceberry are retained.

Control of invasive exotic plants is a necessary component of abandoned field reclamation because invasive exotic species often thrive on disturbance, including the disturbance caused by vegetation clearing. If left untreated, invasive exotic plants can quickly dominate sites and degrade natural communities. Invasive plant control is accomplished through mechanical and/or chemical methods,

depending on the abundance of invasive plants. Small infestations of invasive plants are usually treated mechanically by pulling individual plants and their entire root systems from the ground; larger infestations are typically herbicide-treated to kill the root system and prevent re-sprouting.

Invasive exotics are colonizers which quickly establish themselves in disturbed communities. Faster growing rates, efficient dispersal mechanisms, and tolerance for a wide range of environmental conditions allow invasive exotics to out-compete native species. As the populations and the distribution of invasive exotics increase, the diversity and populations of natives decrease, as does the diversity of habitats available for wildlife. In fact, invasive exotics have been implicated in contributing to the decline of 42% of those species listed as threatened or endangered by the U.S. Fish and Wildlife Service.

Invasive exotic vegetation commonly found on upland sites includes Japanese and common barberry, multiflora rose, glossy and common buckthorn, Asiatic bittersweet, autumn olive, and others. When herbicide control is required, a selective foliar spray or cut-stem application is used. Reclamation sites are not broadcast-treated; only individual invasive exotic plants are treated. Herbicides are applied only by experienced applicators that are licensed by the Massachusetts Department of Agricultural Resources (DAR). Herbicides used are limited to those recommended for use in sensitive areas on rights-of-way by DAR [333 CMR 11.04 (1) (d)]. Sensitive areas include areas within the primary recharge area of a public drinking water supply well, within 400 feet of any surface water used as a public water supply, and within 100 feet of private water supplies, surface waters, wetlands, and agricultural and inhabited areas.

Upland Program sites are not restricted to MDFW property, but rather are located on high-priority public and private properties across the state. In addition to the biological criteria by which sites are selected, any Upland Program site must be open to the public for outdoor recreation, including hunting. The Upland Program has partnered with towns, land trusts, private landowners, private non-profit conservation groups, and other state agencies to undertake active management of early-successional habitats at high priority sites throughout the state.

The MDFW Forestry Program has established general landscape composition goals for primarily forested landscapes that include 15-20% young forest habitat (<30 years old), 65-75% mid-seral forest habitat (30-150 years old), and 10-15% late-seral forest habitat (>150 years old) (Figure 12). Currently, forest cover across Massachusetts is generally 60-90 years old, so there is a lack of both young and late-seral forest habitat (Figure 11). Identifying mid-seral forestlands that will be allowed to develop into late-seral forest, and that will be cut to provide young forest habitat are important management priorities in Massachusetts today.

Potential sites for establishing young forest habitats have been identified on DFW lands through a GIS analysis of forest cover type data. Potential sites for establishing late-seral forest habitats have been identified through a cooperative effort with other state agencies and private, non-profit conservation groups to establish a system of forest reserves on state lands where timber harvesting will not occur. Both of these processes are described below. It is important to note that the MDFW forestry practices described below have been independently certified as meeting the international Forest Stewardship Council (FSC) criteria for sustainable forest management (Seymour et al. 2003).

The analysis for potential young forest sites identified existing stands that were deemed to be either high risk or low quality. High-risk stands primarily included white pine forest growing on hardwood sites (i.e., on soils that typically support hardwood forest). These stands are thought to be at risk because mature pine trees are likely to be highly susceptible to wind-throw and to insect infestations. Low-quality stands primarily included mid-seral forest with relatively open canopies (e.g., 40-60% canopy cover), which typically indicates that high-grade timber cutting occurred prior to state acquisition. High-grade cutting typically removes only the largest, highest quality trees that can be sold for timber, and leaves suppressed trees of poor vigor and limited species diversity.

On high-risk sites, silvicultural prescriptions generally call for shelterwood cutting which typically involves two harvest operations within a 5-10 year period. In the first operation, 40-50% of the overstory trees are removed in order to provide adequate sunlight on the forest floor to regenerate desired tree species that are well suited to the site. Mature, high-quality trees are retained in the overstory to provide seed for the next generation of trees. In the second operation, 30-40% of the original overstory is removed to release young trees that have become established on the site. This process retains 10-30% of the original overstory canopy in clusters of trees to provide structural diversity in the stand, to provide den and cavity trees for wildlife, and to provide a future source of coarse woody debris. This is generally referred to as 'shelterwood with reserves' and typically results in a two-aged stand.

On low-quality sites, silvicultural prescriptions generally call for either the shelterwood with reserves approach described above, or for aggregate retention cutting which typically involves a single harvest operation that removes 70-90% of the overstory. As with the shelterwood with reserves approach, aggregate retention cutting retains 10-30% of the original overstory canopy in clusters of trees to provide structural diversity in the stand, to provide den and cavity trees for wildlife, and to provide a future source of coarse woody debris. Aggregate retention cuts also typically result in a two-aged stand.

Shelterwood cutting typically favors regeneration of tree species that benefit from a moderate amount of shade during the early, seedling stage of development (e.g., white pine and red oak). Aggregate retention cutting typically favors regeneration of tree species that benefit from a good deal of sunlight during the early, seedling stage of development (e.g., black cherry and white ash). On sites that are neither high risk nor low quality, a process called 'group selection' cutting may be used. This process typically removes 20-30% of the overstory trees during each cutting operation, and cutting usually occurs within a stand once every 25-30 years. This approach favors regeneration of tree species that benefit from a good deal of shade during the early, seedling stage of development (e.g., sugar maple and Eastern hemlock), and typically results in forest stands with multiple ( $\geq 3$ ) age classes of trees.

All silvicultural operations on MDFW lands are carried out by private contractors chosen through competitive, public bids. These operations typically involve mechanical harvesting machinery (tracked vehicles with hydraulic systems for cutting and processing individual trees), skidders (wheeled vehicles with either winch or grapple capabilities to move cut trees in steeper portions of harvest sites), and forwarders (wheeled or tracked vehicles equipped with a hydraulic

loader that transport cut trees from within the harvest site to a roadside area from which wood products can be trucked to processing mills).

Potential forest reserve sites were identified through a GIS analysis of 22 extensive, relatively unfragmented forest landscapes that still exist in Massachusetts. A series of ecological attributes were identified to evaluate and compare these relatively unfragmented forest landscapes. Attributes included existing old-growth forest, rare species habitats, amount of protected open space, and amount of interior forest habitat that is buffered from fragmenting features such as roads and development. Eight potential reserve sites on state land were identified ranging from 1,400 -12,000 acres each. The reserve planning process is now going through an extensive public comment period.

To date, no reserves have been established on MDFW lands. Ultimately, 7-8% (8,500-10,000 ac) of MDFW lands could contribute to a network of large reserves, while another 6-7% (7,500-8,500 ac) of MDFW lands could be identified as small, patch reserves centered on forestland wetlands and connecting riparian forests. Together, large and small reserves on MDFW lands would meet the existing landscape composition goal for late-seral forest habitat (Figure 12). It is important to note that large reserves would be established on MDFW land only if adequate buffers of private forestlands could be secured outside a reserve to limit future impacts of fragmentation within a reserve (see Chapter 3B, Fragmentation by Development).

### **Scope of Desired Habitat Management and Restoration**

To date, the MDFW Upland Program has managed over 700 acres of grass and shrubland habitat at 32 sites throughout the state, and on-going biological monitoring has shown that these managed sites provide viable habitat for declining shrubland birds (King and Collins 2005). MDFW estimates that there are likely several thousand acres of abandoned agricultural lands that could be managed for early-successional habitat. Given that the average annual cost to conduct biological monitoring, control woody vegetation, and control invasive species is estimated at \$50-\$100 per acre per year, it would cost \$50,000-\$100,000 annually to maintain 1,000 acres of abandoned field habitat. MDFW will undertake an analysis of all public and private lands in Massachusetts to determine how many acres of abandoned field habitat could be actively managed in the state.

The harvest of renewable wood products from forestland typically generates income for the landowner. However, the wood products markets in Massachusetts currently offer little incentive for many private landowners to cut lower quality trees. As a result, forest cutting practices on private lands typically do not regenerate substantial amounts of young forest habitat (see Chapter 9B, Young Forests and Shrublands). A cost-sharing incentive of about \$100/acre could induce more private landowners to remove low quality trees to create higher quality wildlife habitat. Such an incentive could be applied to 10,000-20,000 acres annually in Massachusetts at a cost of \$100,000-\$200,000 annually.

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## **F. Coordination and Partnerships**

The Division of Fisheries & Wildlife uses partnerships and coordinates efforts in many ways to conserve, manage and restore the fish and wildlife of the Commonwealth. These partnerships can range from important, formal agreements with federal, state, and local governments and non-profit organizations to ad hoc working groups which may come together only for a brief time to address a specific issue or a single species. The one common theme to all of them is the willingness of each of the partners to bring something to the table. And regardless of the partner or the degree of formality, each and every one of them is critical to the mission. It is not our intent to list them all here. Rather, we highlight a few to provide the reader with a sense of the scope of relationships which occur routinely, without much fanfare, to address the issues which affect the fish and wildlife resources of the Commonwealth of Massachusetts and will only be increased through the additional funding provided by the State Wildlife Grant Program and more focused through the guidance provided in the CWCS.

### **Natural Heritage & Endangered Species Program**

To do its work, the Natural Heritage & Endangered Species Program (NHESP) depends on a wide variety of partnerships with national groups such as NatureServe, federal agencies, as well as many statewide and local agencies and private groups.

Key partners in conducting biological inventory and research for rare and endangered vertebrate and invertebrate wildlife species are universities such as UMass-Amherst and the Harvard Forest. Through its Small Research Contracts Program, Natural Heritage contracts with dozens of diverse partners, such as the Athol Bird & Nature Club, to conduct species censuses or biodiversity inventories.

For species recovery and management projects, NHESP is involved with a number of other partners. The Piping Plover and Tern network consists of statewide entities such as MassAudubon and the Department of Conservation and Recreation, as well as a number of other coastal conservation property owners and beach managers, such as The Trustees of Reservations, the National Park Service, and town parks departments. For the federally Endangered Northern



Redbellied Cooter, restoration project facilities such as the Springfield Science Museum, Worcester's New England Ecotarium, and the South Shore Science Center help rear young turtles to give them a "headstart" to reach a less vulnerable size.

In conducting ecological restoration activities, NHESP works closely with groups such as The Nature Conservancy, UMass-Amherst, and DCR in planning and implementing prescribed burns in pitch pine barrens and native grasslands to restore wildlife habitat.

In land protection planning, Natural Heritage works closely with statewide conservation organizations such as MassAudubon, The Nature Conservancy, and the Trustees of Reservations, regional land trusts such as the Wildlands Trust of Southeastern Massachusetts, and local open space committees and land trusts and such, as the Dartmouth Natural Resources Council, to provide information that they can use in their conservation planning activities or to help raise interest and funds in protecting the identified parcels.

In the regulatory area, the NHESP works closely with the state Department of Environmental Protection, the Massachusetts Association of Conservation Commissions, and numerous town conservation commissions in the administration of the rare wildlife habitat protection provisions of the Wetlands Protection Act regulations.

To help promote contributions to the Natural Heritage & Endangered Species Fund, a number of non-profit organizations and professional organizations ranging from the Lloyd Center for Environmental Studies to MassAudubon to the Massachusetts Veterinary Medicine Association have written articles and/or placed NHES Fund promotion advertisements in their membership publications.

A number of partners have funded Natural Heritage to perform comprehensive biodiversity inventories of their properties. These partners include the U.S. Army Corps of Engineers, the National Park Service, the Massachusetts National Guard, and the U.S. Air Force.

Last but not least, the Program has an important administrative relationship with the Manomet Center for Conservation Sciences in the form of annual contract to provide support services for many functions of the Natural Heritage Program.

### **Fisheries Section**

One example of the many partnerships involved in implementing this Comprehensive Strategy is the Connecticut River Anadromous Fish Restoration Program, as described below.

Partnerships are key to the success of the Connecticut River Anadromous Fish Restoration Program given the number of parties involved, the enormity of the Connecticut River basin, and the complexity of the species. The Connecticut River is the longest river in New England, stretching over 400 miles from the Long Island Sound to the Canadian border. The Connecticut River is the southernmost Atlantic salmon river in the United States, supporting over 60 species of fish, 14 of which are migratory. These unique attributes of the Connecticut River basin have shaped and defined the restoration program.

The Atlantic salmon has a complicated life history, traveling over 2,000 miles to Greenland and back during its lifetime. In the Connecticut River basin, its freshwater habitat spans four New England states. The Atlantic salmon has strict habitat requirements throughout this range.

A minimum of six state and federal resource management agencies, major electric utility companies, a host of private dam owners, and a variety of other nongovernmental organizations and individuals are involved with the restoration of Atlantic salmon and other migratory species. Connecticut River Atlantic salmon restoration requires that these different individuals and groups work together cooperatively.

The Connecticut River Atlantic Salmon Commission provides guidance to the restoration program on all administrative and biological issues. Established by Congress in 1983 (and reauthorized in 2002 for another 20 years) through the Connecticut River Atlantic Salmon Compact (Public Law 98-138 and identical laws passed in all four basin states), it is composed of ten Commissioners, representing four State agencies, the public, and two Federal agencies. The following table lists Commission members.

**Connecticut River Atlantic Salmon Commission Membership:**

Federal	U. S. Fish and Wildlife Service: Director, Northeast Region National Marine Fisheries Service: Director, Northeast Region
Connecticut	Connecticut Dept. of Environmental Protection: Director, Fisheries Division Public Sector Representative, Appointed by the Governor
Massachusetts	Massachusetts Division of Fish and Wildlife: Director Public Sector Representative, Appointed by the Governor
New Hampshire	New Hampshire Department of Fish and Game: Executive Director Public Sector Representative, Appointed by the Governor
Vermont	Vermont Department of Fish and Wildlife: Commissioner Public Sector Representative, Appointed by the Governor

Commissioners are advised on scientific and technical issues by a Technical Committee. The Technical Committee is comprised of senior staff biologists from each member agency, plus the U.S. Forest Service and the Massachusetts Division of Marine Fisheries. The Technical Committee has created several standing sub-committees to address specific issues: Shad Studies, Salmon Studies, Fish Passage, and Genetics. Experts and cooperators from the U.S. Geological Survey/Biological Resources Division, private industry, and conservation groups participate in meetings of these sub-committees and the Technical Committee.

Public support for the program has been maintained for over twenty years through inclusion of representatives of the public sector on the Atlantic Salmon Commission and the fruitful involvement of nongovernmental environmental and citizen groups in the Technical Committee process. The Commission also sponsors the Atlantic Salmon Egg Rearing Program (ASERP). ASERP is a cooperative environmental education program designed to both promote an understanding of fisheries restoration and management and provide a hands-on watershed

stewardship experience. Students hatch and raise Atlantic salmon in the classroom and later release the fish in streams within their communities. The interdisciplinary approach encourages student responsibility for the natural environment across a broad age range.

The ASERP program was initiated in 1997 by the Deerfield/Millers River Chapter of Trout Unlimited with the Massachusetts Division of Fisheries and Wildlife and the U.S. Fish and Wildlife Service. It parallels similar programs in New Hampshire, Connecticut and Vermont. Over 100 schools and more than 2,000 students take part in this initiative annually throughout the Connecticut River watershed.

Approximately 600 students in 30 schools located in 25 different towns in western Massachusetts participated in rearing and stocking about 9,000 Atlantic salmon fry in 2005. These towns include Amherst, Ashfield, Becket, Bernardston, Chicopee, Colrain, Easthampton, Gill, Greenfield, Huntington, Leverett, Longmeadow, Monson, New Salem, Northfield, Orange, Rowe, Shelburne Falls, South Hadley, Southampton, Springfield, Sunderland, Westfield, Westhampton, West Springfield, and Williamsburg.

Participating teachers and classroom volunteers take a one-day orientation to the ASERP program every year and a manual of information and activities is available on the Internet at <http://www.fws.gov/r5crc/Salmon/workbook/index.htm>.

Beyond this example, other partnerships involved in restoring and managing wetland and marine habitats include MassWildlife, the Coastal Zone Management Wetlands Restoration Program, the Division of Marine Fisheries (DMF) Recreational and Anadromous Fisheries Program, the DMF Eelgrass Restoration Project, the DMF Bottom Sediment Enhancement Project, the Riverways Program, the Department of Conservation and Recreation Lakes and Ponds Program, and the Executive Office of Environmental Affairs Natural Resource Damages and Assessment Program, along with many private conservation groups.

### **Wildlife Section**

Within the Wildlife Section, there are several programs which illustrate the importance of coordinating efforts with other organizations and the need for establishing partnerships to reaching our shared goals. The Forestry Program and the associated Upland Project seek to manage the forestland owned by the state resource agencies and local towns in ways that are sustainable and provide benefit for wildlife resources. Partners in these efforts include the Natural Resource Conservation Service, Massachusetts Department of Conservation and Recreation, Department of Fish and Game, the Massachusetts Executive Office of Environmental Affairs, along with The Nature Conservancy, Massachusetts Audubon, The Ruffed Grouse Society, The Trustees of Reservations and towns such as Dennis, Massachusetts. Through this partnership, 1200 acres of privately and town-owned land are being managed for early successional forest and to control invasive plants, and nearly 125,000 acres of state forest land are being managed in a sustainable way, providing benefit to the local economy and to species in greatest need of conservation as well.

## **G. Education**

Frequently, human actions or lack of those actions pose a threat to the species or habitats identified as warranting special concern under the guidelines of the Massachusetts Comprehensive Wildlife Conservation Strategy. In many cases, the perceived threats may be ameliorated by raising public awareness and understanding of the issues involved and by increasing the level of information available to the public. In such cases, education is a key tool.

Massachusetts Division of Fisheries & Wildlife staff will review species and habitat conservation strategies to determine where human impacts are among the factors that challenge the sustainability of a species or a habitat type. They will assess public perception and levels of information about these issues and will identify new or existing channels that will serve as effective tools for reaching the target audiences.

To this end, the MDFW will participate in and maintain programs that:

- support public understanding of fish and wildlife resources as a public trust; and
- enhance public appreciation of the role of conservation and management in sustaining and enhancing both terrestrial and aquatic habitats and their associated wildlife populations.

MDFW staff will work independently and with other professionals to:

1. Identify affected publics;
2. Evaluate public perceptions and levels of information through public meetings, surveys, focus groups and other programs as suited to the selected audience. This process will also serve to identify knowledge gaps.
3. Enhance existing partnerships and develop new partnerships with other organizations, including federal, state and municipal agencies, land trusts, natural resource commissions, conservation organizations, community groups, and corporate entities whose interests and actions intersect with the conservation of those habitats and/or species. Staff will also develop and strengthen partnerships with educational institutions and agencies.
4. Determine which issues can be addressed through existing publications or programs and where new publications or programs may be needed.
5. Identify issues that can productively be addressed through existing educational programs and determine where new programs may be needed. Current programs exist for use in both formal (school-based) and non-formal (community based programs, camps, scout and agency programs) educational settings, as well as in informal settings (individually initiated, content-seeking situations). Future programs will be targeted as determined by needs assessments.
6. Determine where issues can be addressed jointly with other agencies or organizations allowing each partner to benefit from economies of scale.

7. Secure funding for educational efforts by seeking grants, developing self-supporting programs, and working in partnership with one or more public or private organizations..
8. Conduct periodic evaluation of educational outreach efforts to assess program effectiveness in increasing public levels of awareness and knowledge and promoting actions that will enhance conservation of potentially affected habitats or species.